All contributions to be sent to the Editor, 19, St. Andrew's Mansions, Dorset Street, W.1.

British Journal of Anæsthesia

Vol. XII. No. 4. July, 1935.

EDITORIAL.

Improving Status of Anæsthetics.

WITHIN the last few months no fewer than three new societies of anæsthetists have been established in Australia, France, and Italy. To them all we extend the hand of cordial welcome, and the more so because two at least of them, the French and Italian, will provide new journals to describe the activities of the societies and to report and encourage all work and research, both clinical and experimental, which concerns anæsthetics. The Australian Society, though it will not, at any rate at first, have a journal of its own, will, we believe, be given the columns of the *Australian Medical Journal* for one or more issues in the year.

Even more notable perhaps than these new enterprises is the establishment by the Royal Colleges of Medicine and Surgery of a Diploma in Anæsthetics. The details of this we give at page 184. Most of our readers are aware of the part which has been played by the Association of Anæsthetists of Great Britain and Ireland in bringing the Diploma to life. That body is to be thanked and congratulated by us all for its initiative, even as the Colleges are to be felicitated on the readiness with which they have accepted the suggestions of the Association and on the admirable manner in which the Diploma is instituted. We

have not the slightest doubt as to the value which this distinction will have in the eyes of the medical profession, or of its benefit to the general public and to surgeons in particular. These developments, which we have enumerated, show without any possibility of misunderstanding the increasing importance of our speciality in the hierarchy of medical activities. This importance is still insufficiently recognized in certain directions, notably at many hospitals where the anæsthetists receive neither the position on the staff nor any other reward commensurate with the extent of their labours for the institutions. Everything cannot, however, be achieved at once. Time will inevitably work for us if we make ourselves both by the degrees which we hold and our general standing, as well as by skill in our speciality the equals of those who lead in the other branches of the practice of medicine and surgery.

AVERTIN: AN ANALYSIS OF 1,600 ADMINISTRATIONS *

By Sir Francis E. Shipway, K.C.V.O., M.D.

THE position of basal narcotics in the field of anæsthesia has become so assured, the public demand for some method of alleviation or abolition of pre-operative anxiety or fear has become so universal that controversy over the wisdom of prescribing these friendly and powerful aids to the weakness of human nature has at last ceased. What has not ceased and probably never will cease is controversy over the relative value, safety and convenience of the many and increasing number of drugs of this nature which are at the command of the bewildered anæsthetist. Avertin was one of the earliest in the field. It has been on trial long enough for a fair and accurate estimate to have been formed of its advantages, disadvantages, and dangers. As one who was partly responsible for introducing it in 1929 to anæsthetists, I feel that an account of my stewardship is due, perhaps overdue, for no summarized data and final conclusions have as yet been published. The present moment seems opportune. Your Chairman has shown both by his friendly visit to the Centenary Meeting of the British Medical Association in 1932 when he presented a most instructive address on "The effects of anæsthetics on the liver,"[1] and by his numerous experimental and clinical investigations of the various actions of avertin, how great is his interest in this drug. He has predicted an abiding usefulness for avertin. With this prophecy, rash though it may be, I am entirely in agreement. In this paper, which I have the honour of presenting to this Congress, I propose to give a summary of 1,600 administrations of avertin, together with indications and contra-indications to its use, and an analysis of the deaths following operations in which it was used.

* Read before the fourteenth Annual Congress of Anaesthetists, Atlantic City, New Jersey (U.S.A.).

In the first 45 administrations in 1928–29, solid avertin was used; in the remaining 1,555 administrations avertin fluid was used. One patient died (Case No. 8).[2] The patient was a man aged 68 years, alcoholic and an old syphilitic, on whom gastro-jejunostomy was performed; he had been given 0.12 gm. per kilo solid avertin and morphine $\frac{1}{6}$ gr. and scopolamine 1/150 gr. A considerable quantity of a mixture of chloroform and ether had been used to obtain relaxation. Death occurred a few hours later from respiratory failure due to lack of the special nursing precautions now considered essential, and of specific antidotes to an overdose of avertin. The effective counteraction of overdose by coramine and ephedrine was not known at that time. Avertin was used to procure complete narcosis, and morphine or morphine-scopolamine was given in every case. In 13 of these 45 cases, no other anæsthetic was necessary. In the remaining 1,555 cases, as already stated, avertin fluid was used and both the dose of avertin and of the preliminary sedative was gradually reduced, or the preliminary sedative omitted, with the result that no fatality which can be attributed to avertin has occurred in a consecutive series of 1,55g administrations of this drug used as a basal narcotic.* The dosage in the great majority of the first 70 cases was larger than in the cases that have followed, and it was combined as a rule with morphine or morphine-scopolamine.

* Since completion of this paper the number has risen to 1,600.

TABLE I.

Dosage in Grammes per Kilo in 70 Cases.

	0.09 grm.	0.1 grm.	0.12 grm.	0.125 grm.	0.13 grm.	0.135 grm.	0.15 grm.
No. of cases ...	1	21	8	6	28	2	4
With morphine or morphine-scopolamine	1	20	8	6	28	2	4
Without	0	1	0	0	0	0	0

Out of the first 147 cases, morphine or morphine-scopolamine was given in 127, and the dose of avertin was in the great majority larger than 0.1 gm. per kilo. After this date the recommendation of Eichholtz to use an average dose of 0.1 gm. per kilo was adopted. Whereas in these 147 administrations, avertin was the sole anæsthetic on 22 occasions, in the following 1,453 administrations avertin gave complete anæsthesia in only 11 cases, in 3 cases no operation was performed, in 3 ophthalmic operations were performed under cocaine, in 3 local anæsthesia with novocain was used, making a total of 20 cases without a general anæsthetic.

Looking back now on these 147 cases one is struck by the fact that in no single instance, except in the one quoted, was any anxiety felt for the safety of the patient during the operation or the recovery period. The conclusion which is irresistibly drawn, and is strengthened by a study of the remaining 1,453 cases, is that the danger of avertin has been exaggerated. It is recognized, on the other hand, that premedication by morphine may lead to danger unless the dosage is carefully calculated. Avertin, it will be remembered, depresses the respiratory centre. Morphine is also a respiratory depressant. The combination of the two may lead to profound lowering of the sensibility of the centre to the normal stimulus, viz. CO_2 to its failure to respond to abnormal stimuli, and finally to respiratory collapse. In the early days of avertin a fatality occurred which caused considerable comment at the time. This was the case of a healthy young man who was operated upon for the radical cure of hernia. He was given avertin 0.1 gm. per kilo and morphine $\frac{1}{4}$ gr. He left the theatre in good condition, but later became cyanosed and died of respiratory failure in about seven hours.[3] Recently a somewhat similar case has been recorded; here the preliminary medication was morphine $\frac{1}{4}$ gr. and scopolamine 1/100 gr., the dose of avertin 0.1 gm. per kilo, and the operation for exophthalmic goitre. Death occurred five hours later, consciousness not having been regained.[4] It is wrong to ascribe these fatalities to avertin. They would not have occurred had avertin alone been given.

It must be clear that the clinical picture will be entirely altered if an amount of avertin sufficient to render a patient unconscious with reduced respiratory volume, relaxed musculature, lowered blood-pressure and diminished reflexes is given after the injection of a drug which also depresses respiration and metabolism. I feel, therefore, that morphine, although exceedingly useful in the right place, should not be given without the most careful consideration of all the circumstances of the case. The risk should not be run except with the eyes fully open. Discredit, wholly unwarranted, will be thrown upon a drug the highest praise of which comes from those who have used it over a long period.[5, 6, 7] In the handling of difficult subjects it is wiser to prescribe a larger dose of avertin, the antidotes of which are known and are reliable.

There is another point worthy of mention. If a sedative or hypnotic has been given overnight, some effect may still be present at the time of the administaration of avertin; the administration in this case should be stopped as soon as signs of sleepiness appear. The barbiturates if used as pre-narcotics should be given at least one hour before avertin, in order that the full effect may be obtained and may be clearly evident. I confess that the combination does not appeal to me. The barbiturates are so capricious in the intensity and duration of their action that their exhibition may give rise to undue anxiety, particularly during the recovery period. Tolerance to avertin may develop with successive administrations. Maddox[8] quotes the case of a child who was given avertin on five occasions at intervals of a few days for mastoid dressing; the doses had to be increased from 0.12 gm. per kilo to 0.2 gm. per kilo. This is the experience of all who have used avertin in a large number of cases.

The young, the robust, the highly nervous and excitable, drug addicts and alcoholics tolerate avertin, generally speaking, better than their opposites. The obese, the cachectic, the anaemic, the toxic patients with low blood-pressure require a smaller dose than the normal. Here I wish to introduce a note of caution for the sake of the anæsthetist whose experience of avertin is limited. The

TABLE II.

Dosage in Grammes per Kilo in 1,453 Avertin Administrations.

	0.06 grm.	0.07 grm.	0.08 grm.	0.85 grm.	0.09 grm.	0.095 grm.	0.1 grm.	0.11 grm.	0.12 grm.	0.13 grm.	Unknown*
With morphine	0	3	22	1	98	6	326	7	0	1	0
Without morphine	3	4	79	0	195	7	662	15	20	0	4
Totals	3	7	101	1	293	13	988	22	20	1	4

* Weight guessed.
Total 1,453.

finely drawn athlete or the soldier, who together with a rigorous abstinence from tobacco and alcohol has trained every ounce of fat off his body, requires a smaller dose than the average. He comes into the category of the emaciated individuals who have depleted their carbohydrate reserves. Weight is only an approximate guide—age, temperament and habits are important factors in the assessment of dose, and of these, temperament has always seemed to me to be the best indicator. There is one class of patient which invariably calls for increased dosage. It includes the artist, the actor, the musician, and all those highly imaginative individuals who live at a higher rate of nervous tension and excitement and possess less control than the ordinary being. They are, as a class, panic-stricken, and when given avertin, fight to the last against the loss of consciousness. In some cases they succeed, although speech has become indistinct and perception of surroundings blurred. A few inhalations of a general anæsthetic suffice to abolish consciousness; amnesia is usually complete, and no harm has been done to the psyche. *Great danger may be run, however, by giving a second dose of avertin, or of a preliminary sedative in the attempt to procure sleep, for once the higher centres have been abolished, the lower are exposed to the full and uncontrolled effects of the drug.*

Indications.

Avertin has been used for a wide variety of operations, and there would seem to be few conditions for which it is not suitable. It is pre-eminently suitable for those suffering from hyperthyroidism, diabetes, cardiac disease and most forms of pulmonary disease, from chronic bronchitis and asthma. It is invaluable for those whose experiences with anæsthesia have been unhappy, and in the field of pyschiatry where the possibility of producing unconsciousness surreptitiously in maniacal patients has placed a weapon of the greatest importance in the hands of the surgeon. One patient of this class to whom I gave avertin underwent cholecystectomy, and, at a later date, tonsillectomy, with the happiest results, for the removal of septic foci enabled him to resume his normal place in society, drive a car, and shoot. It is amusing to think that this patient has never seen me. Age does not appear to be a factor which need influence our decision to use avertin; my cases include patients with ages ranging from $2\frac{3}{4}$ years to 96 years, whilst one of my colleagues has given it to infants for hare-lip and cleft-palate operations. It does influence the amount of the drug to be given, and does also raise the question as to how far avertin or, for that matter, any rectal anæsthetic, is suitable for young children. The question must be answered in each individual case. Much depends upon the temperament and sensitiveness of the child, much upon the character and tact of the nurse. Some children resent with characteristic candour and vigour any attempt at rectal treatment. Others are indifferent. However, when a special request for avertin has been made, or the child has become accustomed to nursing by reason of prolonged or repeated illness, there would appear to be no objection to its use. In any case, the presence of the anæsthetist at the ceremony is unnecessary and indeed unwise.

Avertin can be used with as much advantage for operations on the nose and throat as for operations on other parts of the body, particularly intra-nasal operations on the bronchitic and asthmatic, inasmuch as ether can be avoided entirely. The cough reflex is but slightly dimin-

ished by avertin, and is rapidly regained at the end of the operation. The laryngeal reflex is not abolished. I was encouraged to use this drug in this field of surgery from a conviction that, whilst avertin is undoubtedly a depressant of respiration and of blood-pressure these effects are transitory, and from the observation that its action on the cough reflex has been insignificant, if not, indeed, non-existent in some patients.[9] Stewart,[10] of Montreal, states that "even with sufficient doses to produce deep sleep the cough reflex was most persistent and did not tend to disappear."

Contra-indications.

Provided the dose be suitably adjusted, the contra-indications are exceedingly few. This statement, however, needs qualification. It should apply only to the anæsthetist who has had not only considerable experience in anæsthesia, but in avertin anæsthesia. The practitioner who is called upon to administer anæsthetics on few and irregular occasions, or is but a beginner in this arduous and hazardous speciality, will be well advised to leave avertin severely alone. The chief danger lies in depression of the respiratory centre; the blood-pressure is also lowered. It is better, therefore, if there is any doubt in the mind of the anæsthetist, to withhold it in the case of advanced pulmonary tuberculosis, where the respiratory exchange is poor, in acute empyema, or states of drowsiness whether caused by drug or toxæmia. Extreme thyroid deficiency or a condition of very low blood-pressure due to shock, haemorrhage, sepsis or cachexia would also, speaking generally, render the patient unsuitable for avertin in inexperienced hands. Colitis and intestinal obstruction should also be looked upon as contra-indications. Cyanosis due to congenital heart disease or chronic valvular disease does not forbid its employment, although it does, of course, prescribe a smaller dose than the average. Deepening of cyanosis, after absorption has occurred, should be countered by a plentiful supply of oxygen and the maintenance of a free airway. It is true that coramine, ephedrine and carbon dioxide are efficient antidotes to excessive dosage

of avertin, if given in time and with judgment. Washing out the rectum on the first sign of overdose, such as slow shallow respiration and slow feeble pulse, is also a measure not to be despised. "I have noticed that on those occasions on which the solution has been returned even as late as half an hour after injection, or on which it has been deliberately syphoned off—for example, before the performance of a plastic operation on the perineum—there has been a definite diminution in the depth of narcosis. In one case of extreme overdose (10 times) reported to me . . . washing out the rectum was effective, and the operation was completed without mishap or complication."[11]

Since the main work of detoxication of avertin is done by the liver, the view has been held that patients suffering from cirrhosis or jaundice are unsuitable subjects for its administration. Avertin belongs to a group of drugs, the halogen group of organic compounds, which have a toxic action on the liver. This group includes chloroform and ethyl-chloride. Adrian[12] has stated that the results obtained by Parsons in his investigation of the effects of avertin on the liver of rabbits "though negative are of considerable value, as they show that avertin has not the toxicity to the liver which seemed probable from earlier work." Bourne, Bruger and Dreyer,[13] using the bromsulphalein dye test in dogs, state that avertin occasionally produces impairment of function, but the degree is slight, and gives good comparison with ether and the barbiturates. They conclude that it is less damaging than ether or chloroform.

Professor Anschütz, of Kiel, informed me in 1932 that he no longer believed that avertin is a liver poison, even if this organ were diseased. He had himself operated on 40 jaundiced patients with over 10 mgr. per cent bilirubin in the blood; one woman, aged 65 years, had severe jaundice with 18 mgr. per cent bilirubin and liver abscesses, whilst one patient had 19 mgr. per cent bilirubin. All recovered. In a recent letter (November 1934) he tells me that he continues to have good results with avertin in jaundiced patients even when the bilirubin figure was four times the normal. After operation he gives a large intravenous infusion of 5 per cent to 10 per cent glucose solution.

He has completely given up ether for patients with severe jaundice. This decision obtains confirmation from the notes of the following case which occurred in my own practice.

> A stout woman, of 59 years of age, jaundiced, no albumin in urine, blood-pressure not raised, was operated on under morphine and scopolamine and nitrous oxide, oxygen and ether anæsthesia for removal of the gall-bladder and of stones from the common bile-duct. After operation, the blood-urea rose steadily to 164 mgm. per cent, fell to 60 mgm. under treatment, but rose again, the patient dying on the sixteenth day from uræmia due to liver failure. Had this patient been given avertin, death would certainly have been laid at its door by its opponents.

Ashworth[14] has decribed three cases, two deeply, and one slightly jaundiced, who were operated on under avertin; all made good recoveries. Sebening[15] states that patients with diseases of the biliary tract show a certain prolonged detoxication. Van Zyl,[16] investigating liver efficiency by the lævulose test in 12 patients operated on under avertin and stovaine, found that four (including one suffering from alcoholic cirrhosis) showed deficiency before anæsthesia and complete incapacity of dealing with lævulose after anæsthesia. In every case, however, convalescence was smooth. He concludes that avertin is only contra-indicated if the deficiency in liver function is marked.

Zadek[17] and his co-workers investigated the value of the functional tests of the liver and concluded that a more rapid and more certain estimation of liver efficiency could be obtained by ordinary clinical methods. They found that the galactose tolerance test was of value in not more than 50 per cent of patients, and actually gave a positive result in one patient not suffering from liver disturbance. The dye test they found to be unpleasant, and the test of the excretory function of the liver to be quite unreliable.

Madan[18] has obtained good results in cases of suppuration in the gall-bladder and of jaundice. Arnheim and

Tuchman[19] found a negligible change in blood cholesterol in 15 normal patients given avertin. There are several instances in the literature both of the repeated administration of avertin and of the administration of large quantities for the relief of tetanus, eclampsia and mania. No harm resulted.

I have used avertin in 55 operations on the gall-bladder. The notes of the following cases are of especial interest.

(1) Female, 50 years of age, suffering from acute cholecystitis with jaundice and high tempearture. Had been given avertin on two previous occasions for operations on the kidney. Gall-bladder drained under avertin 0.1 gm. per kilo and nitrous oxide and oxygen. Rapid recovery.

(2) Female, 56 years of age, stout and diabetic. Treated with insulin for two days, and insulin and glucose before operation. Avertin 0.1 gm. per kilo, morphine $\frac{1}{6}$ gr., nitrous oxide, oxygen and ether. Good recovery.

(3) Female, aged 54 years, slightly jaundiced, very ill, abdomen distended. Operation revealed rupture of caecum, early peritonitis. Abdomen drained, gall-bladder removed. Avertin 0.1 gm. per kilo, nitrous oxide, oxygen. Good recovery.

(4) Female, 55 years of age. Abdominal exploration revealed congenital cystic disease of the liver; very little heatlhy tissue remained. Avertin 0.1 gm. per kilo, nitrous oxide, oxygen. Good recovery.

(5) Female, 54 years of age. History of alcoholism. Operation revealed early fatty cirrhosis. Gall-bladder removed, slight jaundice ensued for three days. Good recovery. Avertin 0.1 gm. per kilo, nitrous oxide, oxygen and a considerable quantity of ether.

The ages of five patients were 70, 71, 74, 74, 76. All made uninterrupted recoveries. In two cases cyclopropane was used.

Children, who are notoriously susceptible to chloroform, should on *a priori* grounds be unsuitable subjects for avertin, which belongs to the same group of organic compounds. And yet out of 158 administrations to children of

12 years of age and under, I have seen only one case in which jaundice developed, although I have given avertin twice to a child in 14 hours, normal recovery ensuing. The notes of the case of jaundice are as follows:

Boy aged 10 years, history of acidosis for many years. Tonsillectomy under avertin, nitrous oxide, oxygen. Pyrexia 100 to 101°F. after operation with pain in appendix area and occasional vomiting. Appendicectomy three weeks later; avertin, ethyl chloride followed by nitrous oxide, oxygen and a small quantity of ether. Slight pyrexia for a week after operation, poor appetite. Slight jaundice started four days after operation and lasted for a week. Normal recovery followed.

TABLE III.
Anæsthetics in Gall-bladder Operations.

(1) N_2O, O_2	18	(6 with nerve block)
(2) N_2O_2, E	12	(2 ,, ,, ,,)
(3) N_2O_2, E, N_2OO_2	9	(1 ,, ,, ,,)
(4) N_2OO_2, vinethene	3	
(5) Ethylene, O_2	1	
(6) Cyclopropane, O_2	3	
(7) Ether	8	(1 ,, ,, ,,)
(8) CE.	1	
	55	10

The conclusion to be drawn from a study of these cases and of the facts quoted, is that the estimation of liver function is desirable but not essential. There is sufficient clinical evidence to show, beyond any reasonable doubt, that avertin may be administered in a dose suitably adjusted to patients suffering from jaundice, cirrhosis, or other forms of liver damage. If, on the other hand, a test of liver efficiency is considered desirable, the question at once arises which is the most reliable as regards anæsthetic risk. Of the many functions of the liver, some authorities attach importance to its bile-producing function (Anschütz), some to its toxyphylactic (Bourne and Rosenthal),[20] some to its

physiological function of storing glycogen (Willcox),[21] lævulose or galactose being used for this purpose. Willcox thinks that the lævulose test "best shows early impairment of function." The results obtained by van Zyl[16] and Zadek show how inefficient the sugar tolerance test is. Unfortunately, it must be admitted that we have no reliable indication of the amount of impairment of function, and most of the tests are unsatisfactory in that they fail to indicate loss of hepatic function until a condition of fatal necrosis has developed. Clinical examination is, and must, remain for the present, the decisive factor.

To sum up, jaundice of a mild degree, which quickly cleared up, developed after two out of 1,600 administrations of avertin, namely in a child with a long history of acidosis and in an adult with fatty cirrhosis of the liver. In the first case some ether, in the latter a considerable quantity had been given. On the other hand, two jaundiced patients, both very ill, were operated on under avertin; both made uninterrupted recoveries. These results would seem to show that the toxicity of avertin even to the damaged liver has been exaggerated, and that if an operation is contemplated under general anæsthesia in the presence of jaundice or hepatitis there is no reason why the patient should not be given the benefit of the doubt, the use of ether being avoided.

Since the presence of glycogen in the liver cells seems to increase their power of resistance to toxic agents, glucose should be given freely before the administration of avertin, and if the liver function is impaired it should be given for 24 hours before operation and again at the end of the operation, either intravenously or per rectum. If avertin anæsthesia has to be supplemented by a general anæsthetic, nitrous oxide and oxygen is preferable to ether. Since it has been shown that reduction in the oxygen supply interferes seriously with liver function, cyanosis during administration of nitrous oxide and oxygen must be avoided. If difficulty is anticipated in obtaining abdominal relaxation without recourse to ether, it should be obtained by the injection of a local anæsthetic.

The effect of avertin on the kidney function is to produce

marked depression for one or two hours in animals, but much less in man, probably because of the smaller dose employed. Bolliger and Maddox[22] found that avertin anæsthesia without surgery produces no ill-effects in uræmic dogs. Excretion was slow but recovery was complete. Pitt[23] has recently investigated at Guy's Hospital the effect of avertin on the renal function in patients suffering from a variety of conditions—nitrous oxide and oxygen or a minimal amount of ether in addition was used as the supplementary anæsthetic. Blood-urea estimations were made before and after operation by Archer's micro-urease method. All urine passed during the following days was collected and examined. Pitt concluded from his investigations that nitrogen excretion is less upset by avertin than by chloroform and ether. There is a slight rise after avertin, nitrous-oxide and oxygen anæsthesia on the day following operation. A complete cessation of kidney function which lasts for 20 to 90 minutes frequently follows the administration of avertin. The upset of function does not assume dangerous proportions in the older patients. In fact avertin appears to be slightly more favourable in this respect than chloroform and ether.

It will be seen from Table IV that 53 nephrectomies have been performed under avertin; nitrous-oxide, oxygen, with or without the addition of a minimum amount of ether or vinethene was the supplementary anæsthetic. Three patients died, one on the fourth day from peritonitis, verified by autopsy, one on the fifteenth day, from pulmonary embolism (the ureter had also been removed), and one in 30 hours from circulatory failure. This patient was aged 64 years, and was very toxic in consequence of a long-standing pyonephrosis; the operation was difficult on account of dense adhesions. In 40 cases the kidney has been operated on for removal of calculi. There has been no fatality. Forty-four prostatectomies have been performed by the open method and 23 by Freyer's operation. Of the former, two were second-stage operations, and of the latter, seven. The decision *when to operate* and what *operation to do* has been formed partly from a consideration of the general condition of the patient, particularly from the

cardio-vascular point of view and partly from an estimation of the results of the investigation of the blood-urea, and of McLean's test for urea excretion. It is not my intention to discuss the value of these tests, even if I were qualified so to do, but to point out that in the final analysis, due emphasis must be laid upon the efficiency of the cardio-vascular system. In the long run the excretion of urea must depend very largely upon the maintenance of an adequate arterial pressure in the kidneys. A low blood-pressure and a severe degree of arterio-sclerosis are therefore viewed with suspicion and call for the minimum of surgical interference and the employment of a non-toxic anæsthetic, even though the tests of renal function may be considered to come within safe limits. Further, every effort is made to maintain the blood-pressure during the post-operative period. No patient who has been judged suitable for operation has been refused avertin on the grounds of renal deficiency.

One patient died from uræmia on the ninth day. Age 66 years, weight 16 stone (224 lbs.), bronchitic, legs oedematous, blood-pressure 250/150 mm. Hg. Blood urea 56 mg. per cent. Pyuria. Avertin 0.09 gm. per kilo, local anæsthesia. Restless—chloroform 10 minutes—supra-pubic prostatectomy. Gradual renal failure. Autopsy, stomach, small intestines very dilated. Free fluid in peritoneal cavity. Liver, kidneys, normal.

This patient was clearly a very unfavourable subject; his condition was at a standstill in spite of treatment, and operation could not be further postponed. The fatal ending can hardly be ascribed to avertin. An extended experience of anæsthesia in genito-urinary surgery has taught me that in border-line cases—and this was undoubtedly one—the trauma of operation, even drainage of the bladder performed under local anæsthesia, may be the starting-point of renal failure. When, in addition to a pre-existing infection of the urinary tract a toxic anæsthetic is administered, the issue must always be in doubt.

One patient died from cardiac failure, one from acute obstruction caused by an unsuspected growth of the lower

TABLE IV. *Nature of Operation.*

(1) Face	21
(2) Mastoid	36
(3) Eye	5
(4) Nasal septum and sinuses	136
(5) Mouth	41
(6) Tonsillectomy	220
(7) Pharynx and larynx	9
(8) Neck	14
(9) Goitre:	
Exophthalmic	22
Adenoma	17
(10) Chest	18
(11) Breast	43
(12) Abdominal:	
Upper abdominal	27
Lower abdominal	13
Stomach	32
Bowel	41
Incisional hernia	11
Appendicectomy	156
Ovary, uterus, tubes	43
Various	3
	908
(13) Gall-bladder:	
Removal*	45
Drainage	10
(14) Radical cure of hernia	62
(15) Kidney:	
Removal†	53
Calculi	40
(16) Bladder	137
(17) Prostate:	
Open operation‡	44
Freyer	23
(18) Rectum	27
(19) Hæmorrhoids	26
(20) Genitalia	35
(21) Cervix and curettage	53
(22) Limbs	108
(23) Miscellaneous	29
	692

* In 6 cases appendicectomy performed; in 1 case appendicectomy and ovariotomy performed; in 1 case partial colectomy performed; in 2 cases appendicectomy and cæcostomy performed.

† In 2 cases ureter also removed; in 1 case testis also removed.

‡ In 2 cases vasotomy performed.

bowel, and one from septicæmia; the prostrate in this case contained an abscess. Two patients died from paralytic ileus. In the present state of our knowledge these fatalities cannot be attributed to avertin or indeed to any anæsthetic. Bonney, in his Bradshaw Lecture, 1934,[24] attributes this complication to the generation of some agent in the traumatized tissue "in or in close relation to the peritoneal cavity" which sets up motor and vasomotor disturbances in the intestines.

Pulmonary Complications.

Pulmonary complications have arisen in six cases, and it will be seen that in five of them an infection of the respiratory tract was already present. Although the patient who underwent a repair for umbilical fistula was given nitrous-oxide and oxygen he developed a most serious illness involving first one lung and then the other. His case demonstrates the supreme importance of enquiry into the patient's recent history, particularly in the winter months when so many of the hospital class are inclined to take a "cold" for granted and to conceal the fact for economic reasons. No patient died from a pulmonary complication. No patient has been refused avertin because of bronchial or pulmonary infection, in fact, it has been in this very class that avertin and nitrous-oxide and oxygen has been the anæsthetic of selection, whether for intra-nasal, abdominal, biliary tract, renal, vesical or prostatic operation.

Fatalities.

The causes of death call for little explanation. Reference has already been made to case No. 8, in which avertin and morphine-scopolamine had been used to produce complete anæsthesia before the danger of this method had been recognized. The old lady of 96, who was restless and wandering, absorbed sufficient avertin, and no more, to make operation under local anæsthesia just possible. She was able to take tea shortly afterwards; bronchitis set in on the third day and death took place on the sixth day. In Case 1082 death was probably due to paralytic ileus; considerable force had been used in inserting the tube and morphine given for the

relief of pain. The abdomen became distended on the second day, the patient was reading his paper on the morning of the third, but died suddenly in the early afternoon, probably from asphyxia due to increasing pressure on the diaphragm. It is unfortunate that acetylcholine was not used in this case. It is worthy of note that whereas three patients died from paralytic ileus after extra-peritoneal operation, no instance has occurred of fatal or even an alarming degree of ileus after operation within the peritoneal cavity.

Summary.

(1) The dosage of avertin should be individual.

(2) Given in accordance with established principles it can be used with complete safety.

(3) Drugs which depress respiration should not be given before avertin until the anæsthetist has gained full experience of its action. Larger doses of avertin are preferable in difficult subjects.

(4) Liver and kidney disease are not contra-indications to its use, but call for reasoned dosage: nitrous oxide and oxygen is preferable to ether.

(5) Avertin reduces post-operative morbidity and mortality.

References.

1. Bourne, Wesley. *Brit. Med. Journ.*, 1932, ii, 319.
2. Blomfield, J., and F. E. Shipway. *Lancet*, 1929, i, 546.
3. MacWilliam, H. H., and A. K. Wilson. *Brit. Med. Journ.*, 1929, i, 1141.
4. Love, R. J. M. *Brit. Med. Journ.*, 1934, i, 327.
5. Widenhorn, H. *Anæsthesia and Analgesia*, 1932, xi, 2, 60.
6. Young, J., and N. S. Fraser. *Brit. Med. Journ.*, 1934, i, 455.
7. Bourne, W. *Canad. Med. Assoc. Journ.*, 1934, xxxi, 276.
8. Maddox, J. K. "Avertin Rectal Anæsthesia," 1931, 22.
9. Shipway, F. E. *Journ. Laryn. and Otol.*, 1933, xlviii, 6, 390.
10. Stewart, C. C. *Anæsthesia and Analgesia*, 1933, xii, 2, 49.
11. Shipway, F. E. *Lancet*, 1932, i, 1278.
12. Adrian, E. D. *Brit. Med. Journ. Supp.*, 1932, ii, 170.

13. Bruger, M., W. Bourne, and N. B. Dreyer. *Amer. Journ. Surg.*, 1930, ix, 82.
14. Ashworth, H. K. *Brit. Med. Journ.*, 1932, i, 1123.
15. Sebening, W. *Anæsthesia and Analgesia*, 1932, xi, 4, 145.
16. van Zyl, F. D. du T. *South African Med. Journ.*, 1933, vii, 579.
17. Zadek, E., A. Tietze, and K. Gebert. *Klin. Wochenschr.*, 1933, xii, 60.
18. Madan, K. E. *Brit. Journ. Anæs.*, 1933, ii, 20.
19. Arnheim, E. E., and L. R. Tuchman. *Arch. Surg.*, 1934, xxix, 1.
20. Bourne ,W., and S. M. Rosenthal. *Journ. Amer. Med. Assoc.*, 1928, cl, 377.
21. Wilcox, W. *Lancet*, 1931, ii, 3.
22. Bolliger, A., and J. K. Maddox. "Avertin Rectal Anæsthesia," 1931, 45.
23. Pitt, N. E. *Lancet*, 1935, i, 741.
24. Bonney, V. *Lancet*, 1934, ii, 1323.

TABLE VI.

Summary of Anæsthetics Used.

Nitrous oxide and oxygen	689
Nitrous oxide, oxygen, and ether	275
*Nitrous oxide, oxygen, ether; nitrous oxide and oxygen	88
Nitrous oxide, oxygen, chloroform and ether	9
Nitrous oxide, oxygen and vinethene	90
Ether	314
Ethylene and oxygen	18
Cyclopropane and oxygen	5
Chloroform and ether	24
Chloroform	13
Spinal	12
Local anæsthesia	3
No anæsthetic	42
Various combinations	18
	1600

* Ether used during induction only.

TABLE V.
Pulmonary Complications.

	Sex	Age	Anæsthetic	Operation	Remarks
Pneumonia	M	48	E.	Gastro-jejunostomy	Chronic bronchitic. Patch at base.
Broncho-pneumonia ...	F	38	N_2O, O_2	Caesarean section and removal of Fallopian tube	Emergency operation. Admitted with bronchitis. Recovery.
,, ,, ...	M	37	E.	Nephrectomy	Alcoholic—recent "cold".
Collapse·					
(*a*) Partial	M	39	N_2O, O_2, E.	Partial gastrectomy	Quick recovery.
,, ...	M	53	N_2O, O_2, E.	Prostatectomy	Bronchitic, alcoholic. Fourth day. Recovery.
(*b*) Massive	M	28	N_2O, O_2	Repair of umbilical fistula	Starting a "cold", but did not reveal this fact. Long serious illness, bilateral collapse, R. empyema, thoracoplasty. Recovery.

TABLE VII.

No.	Sex	Age	Injection	Dose (grm. per kilo)	Other anæsthetics	Operation	Time after operation	Cause	Remarks
8	M	68	Morphine gr. 1/6 Scopolamine gr. 1/150	0.12	C, E, O_2	Gastro-jejunostomy	7 hours	Overdose	Autopsy. Syphilitic atheroma. Cirrhosis of liver. Fatty heart.
65	F	16	Morphine gr. 1/6 Scopolamine gr. 1/150	0.1	N_2O, O_2, E.	Thyroid-ectomy. (Exophthalmic)	4 hours	Shock	Apex beat ½" outside nipple line.
147	M	33	Atropine gr. 1/100	0.1	Novocain, N_2O, O_2	Thoraco-plasty	2 weeks	Cerebral abscess	Autopsy. Multiple abscesses in brain.
246	M	47	Atropine gr. 1/100	0.1	Novocain, E.	Appendicectomy	5 days	Obstruction	No autopsy.
326	M	42	Morphine gr. 1/6 Atropine gr. 1/100	0.1	N_2O, O_2, E.	Appendicectomy	10 days	Pulmonary embolism	Autopsy.
359	M	24	Atropine gr. 1/100	0.1	N_2O O_2, E.	Nephrectomy	4 days	Peritonitis	Autopsy.

TABLE VII (*continued*).

No.	Sex	Age	Remarks	Dose (grm. per kilo)	Other anæsthetics	Operation	Time after operation	Cause	Remarks
454	M	61	Morphine gr. 1/8 Atropine gr. 1/100	0.1	N_2O O_2, E.	Resection, growth of colon	5 days	Peritonitis	No autopsy.
559	M	60	Atropine gr. 1/100	0.09	N_2O, O_2	Radium into growth of lung	36 hours	Cardiac failure	No autopsy.
605	F	50	Atropine gr. 1/75	0.09	N_2O, O_2	Exploratory laparotomy	36 hours	Bronchitis	19st. 10lb. Alcoholic, bronchitic. No autopsy.
657	M	77	Atropine gr. 1/100	0.09	E, O_2	Prostatectomy (open operation)	1 week	Cardiac failure	Arterio-sclerosis. Extra systoles. No autopsy.
705	M	58	Morphine gr. 1/6 Atropine gr. 1/100	0.1	Novocain, N_2O, O_2, E.	Exploration of pancreatic duct.	4 days	Pancreatitis	No autopsy.

TABLE VII (*continued*).

No.	Sex	Age	Remarks	Dose (grm. per kilo)	Other anæsthetics	Operation	Time after operation	Cause	Remarks
782	F	96	Nil	0.07	Cocaine	Cataract	6 days	Bronchitis	Blood-urea 93mg.%. Urea concentration test 1.4%. No autopsy.
822	M	74	Atropine gr. 1/100	0.09	Novocain, N_2O, O_2	Prostatectomy	5 weeks	Septicæmia	Abscess in prostate. No autopsy.
823	M	68	Atropine gr. 1/100	0.1	E.	Passing Souttar's tube.	40 hours	Mediastinitis	Œsophageal carcinoma. No autopsy.
924	M	66	Atropine gr. 1/100	0.09	Novocain, chloroform, for 10 mins.	Prostatectomy	8 days	Uræmia	Autopsy. Stomach small, intestines dilated. Free fluid in peritoneal cavity. Kidneys, liver, spleen, normal.

TABLE VII (*continued*).

No.	Sex	Age	Remarks	Dose (grm. per kilo)	Other anæsthetics	Operation	Time after operation	Cause	Remarks
953	F	55	Nil	0.07	N_2O, O_2	Exploratory laparotomy	36 hours	Peritonitis	Appendix abscess 6 weeks before. No autopsy.
996	M	62	Atropine gr. 1/100	0.1	Novocain, N_2O, O_2, E.	Prostatectomy (2nd stage)	5 days	Paralytic ileus	Autopsy. Intestines greatly distended. Flakes of lymph on peritoneum.
1015	F	34	Morphine gr. 1/6 Atropine gr. 1/100	0.1	N_2O, O_2	Acute gangrenous appendicitis with peritonitis	6 days	Peritonitis	No autopsy.
1076	M	70	Atropine gr. 1/100	0.09	Novocain, N_2O, O_2	Prostatectomy (open operation)	76 hours	Paralytic ileus	No autopsy.
1082	M	73	Atropine gr. 1/100	0.09	N_2O, O_2	Passing Souttar's tube for œsophageal carcinoma	4 days	?Paralytic ileus ?Pulmonary embolism	No autopsy.

TABLE VII (*continued*).

No.	Sex	Age	Remarks	Dose (grm. per kilo)	Other anæsthetics	Operation	Time after operation	Cause	Remarks
1099	M	22	Atropine gr. 1/100	0.08	E, O_2	For acute intestinal obstruction	11 hours	Obstruction	12ft. gangrenous small gut. No autopsy.
1224	M	64	Atrpoine gr. 1/100	0.08	N_2O, O_2	Nephrectomy	30 hours	Circulatory failure	No autopsy.
1303	M	60	Atropine gr. 1/100	0.1	N_2O, O_2, vinethene	Removal of kidney and ureter	15 days	Pulmonary embolism	No autopsy.
1397	M	45	Morphine gr. 1/6 Atropine gr. 1/100	0.1	N_2O, O_2	Amputation through thigh	1 week	Pulmonary embolism	Diabetes. No autopsy.
1406	M	68	Atropine gr. 1/100	0.09	Novocain, E.	Prostatcetomy (open operation)	6 days	Obstruction	No autopsy.

TABLE VII (*continued*).

No.	Sex	Age	Remarks	Dose (grm. per kilo)	Other anæsthetics	Operation	Time after operation	Cause	Remarks
1494	M	47	Atropine gr. 1/100	0.09	N_2O, O_2, E.	Partial gastrectomy	5 days	Peritonitis	Autopsy.
1532	M	50	Atropine gr. 1/100	0.09	Cyclopropane	Draining gall-bladder and common bile duct, appendicectomy	48 hours	General peritonitis and hypostatic pneumonia	Autopsy.
1545	F	40	Atropine gr. 1/100	0.09	N_2O, O_2, E., vinethene	Removal of gall-bladder (adhesions, old perforation)	72 hours	Hæmorrhage	Autopsy.

SPINAL ANÆSTHESIA

By Prof. Joseph Sebrechts, University Louvain.

A Reply.

UNDER the heading "A Criticism," Dr. E. Falkner Hill has kindly commented in No. 2 of this journal upon my article on spinal anæsthesia, published in No. 1 (October 1934). His paper calls for some complementary remarks.

I am convinced that most of the techniques of spinal anæsthesia, when used by experienced anæsthetists, can give excellent results, and before selecting percaine, I used thousands of times with success cocaine, tropacocaine, stovaine, procaine, delcaine and tutocaine (which is excellent).

If the heavy viscous procaine solution gives Dr. Falkner Hill entire satisfaction, there is certainly no reason for him to abandon his method. It is a fact, nevertheless, that *many anæsthetists do not obtain satisfactory results with the usual techniques for upper abdominal anæsthesia* because they have not had the opportunity of acquiring gradually the necessary experience. As a result, insufficient anæsthesias are frequent, unexpected accidents are no exceptions, and cephalalgias are not infrequent.

Seeing that in Belgium there are but very few specialized anæsthetists, spinals being carried out by the surgeon or an assistant, I have endeavoured after a long experience to create a method which, taking into consideration the individual sensitivity of the patient, even an inexperienced anæsthetist is able to obtain in all cases a good anæsthesia which satisfies the patient, at the same time affording to the surgeon complete muscular relaxation with the minimum of danger and without any post-operative troubles worth mentioning. *The fractional injection of a highly diluted and hypobaric percaine solution into the lower lumbar region provides the above desiderata.* My paper in No. 1 of this journal was published at the request

of a number of British surgeons who on several occasions honoured me with visits, and in order not to abuse the hospitality of the journal, I condensed it as much as possible, confining myself to the facts, which, in my opinion, it is absolutely indispensable to know before attempting spinal anæsthesia. It is, therefore, not surprising that an authority such as Dr. Falkner Hill, Lecturer on Anæsthetics at the University of Manchester, should have been disappointed when comparing my paper, which was intended to encourage those who might wish to try the *simplified method of spinal anæsthesia,* with the more comprehensive paper which appeared in the *Bulletin de l'Académie de Médecine* in 1930. My purpose was to simplify the method so that the anæsthetist could concentrate the whole of his attention on a few essential points, which are:

(*a*) Painless *low lumbar puncture* with a fine needle.

(*b*) Fractional injection of the anæsthetic agent, *commencing with a dose which can in no case cause an accident.*

(*c*) *Watching the respiration,* which is even more important than watching the blood-pressure and the pulse.

(1) *I said that I did not consider it necessary to take the blood-pressure during the anæsthesia.* Dr. Falkner Hill considers that the regular observation of the blood-pressure can give much *valuable* information. I agree entirely with him, and believe that the trained anæsthetist would be wrong in neglecting this source of precise information. From a purely practical point of view, however, I believe that the observation of the blood-pressure has the inconvenience of alarming unduly and without reason the inexperienced anæsthetist and of monopolizing all his attention, whereas *it is more important, when using percaine, to watch the respiration, the facies, the consciousness,* and, if necessary, the pulse *of the patient.*

It would seem that Dr. Falkner Hill is not far from sharing my opinion seeing that he writes: "A mere fall of blood-pressure unaccompanied by other untoward signs is, I agree, of no clinical importance, and needs nothing but a slight Trendelenburg position," and on page 71: "If the fall of blood-pressure that occurs during the operation be

accompanied by other symptoms of a serious nature and the general picture is alarming, etc."

It thus appears that Dr. Falkner Hill has witnessed, like myself, instances of a really dangerous fall of blood-pressure accompanied (I would rather say preceded) by clinical symptoms: pallor, agitation, air hunger, etc., which attract the attention of the anæsthetist inducing him to watch the pulse and to take the necessary measures.

(2) *I made the following statement*: "*We do not advise the injection of ephedrine as a preventive measure, with the exception of patients who are particularly frail*, because it diminishes the quality of the anæsthesia and increases the blood oozing. On the other hand, we are in favour of using ephedrine and preferably adrenalin, when really alarming symptoms take place." The "particularly frail" patients are those whose blood-pressure (*which we always take before the operation*) is distintcly low, those whom we suspect to be constitutionally rachi-sensitive, or those who belong to the group of rachi-sensibilized subjects (cases of full-term pregnancy and patients intoxicated through the bile, the urea, the products of intestinal retention, and of cellular necrobiosis, etc.) With these patients the injection of ephedrine before anæsthesia is very useful. Dr. Falkner Hill, who uses a heavy viscous procaine solution, is in favour of the preventive injection of ephedrine in all cases. Since using percaine in fractional injections I have abandoned this practice, but I agree that those who have no experience whatever of spinal anæsthesia, should, in their first spinals above the umbilicus give a preventive injection of ephedrine to every patient. Once they have overcome their initial anxiety they wlil be able to determine the cases where ephedrine is really indicated and those where it is more dangerous than useful. When the fall of blood-pressure is due to profuse haemorrhage, ephedrine alone is not sufficient; a transfusion of blood is necessary or an infusion of saline solution with ephedrine or even adrenalin (half a milligram per litre).

(3) *I do not agree with Dr. Falkner Hill when he writes*: "*I have never found ephedrine of use after the blood-pressure has gone down.*" This is true when ephedrine is

injected *subcutaneously* or *intramuscularly*, probably because the resorption is too slow and the action too weak. *On the other hand, when in the presence of untoward symptoms of moderate severity one injects intravenously 1 or 2 c.c. of ephedrine the blood-pressure rises almost immediately.* In the presence of really alarming symptoms (which fortunately are no longer observed by us) I would not hesitate to use the most reliable procedure, i.e. the intravenous injection of 1 milligram of adrenalin followed by the slow intravenous injection of saline solution containing 1:1,000 adrenalin.

I have noted with interest the practice of Dr. Falkner Hill, who in these cases injects a saline solution intravenously and pituitrin intramuscularly. However, I believe that in really dramatic accidents in which the patient is apparently dead it is preferable to act quickly and to inject first adrenalin intravenously or intracardially, whilst, of course, appliyng artificial respiration.

(4) *I remarked*: *"In spinal anæsthetics without percaine the blockage of the orthosympathetic nerve constitutes the main danger. In spinal anæsthesia with percaine the main danger is the paralysis of the respiratory muscles."*

Dr. Falkner Hill has found in one of my papers, published when I was using tutocaine (and not novocain), a sentence which appears to him to contradict my present statement that "in spinal anæsthesia without percaine the blockage of the orthosympathetic nerve constitutes the main danger." The said sentence reads as follows:

"The action of the alkaloid which manifests itself successively by the abolition of sensitivity and motility, then by the abolition of the functions of the sympathetic, is by far the most pronounced, the most extensive and the most prolonged on the sensitive fibres; the action of the alkaloid is less intense, exerts itself on a much more limited area, and is of considerably shorter duration on the motile fibres; it is restricted and of comparatively short duration on the sympathetic fibres."

The contradiction is only apparent because the statement quoted, which describes in general terms the action of any alkaloid on the different fibres, is amplified by the

following sentence describing the particular action of each anæsthetic agent used: "*Fortunately the choice of the anæsthetic agent permits of regulating (so to say) at will, the intensity of the blockage of these three groups of radicular fibres. Every anæsthetic agent used in spinal anæsthesia exerts a different action on the sensitive motor, and orthosympathetic nerves.*"

On the basis of our clinical experiments we may say: (1) That cocaine gives a good analgesia, a moderate muscular paralysis and that it excites the orthosympathetic nerve instead of paralysing it; if it had no other drawbacks, cocaine, which is a good analgesic agent, would be the ideal anæsthetic for thoracic surgery, because it does not paralyse the orthosympathetic nerve, but it is a poor anæsthetic agent in abdominal surgery because it insufficiently paralyses the walls.

(2) Novocain causes an impregnation which is insufficient from the point of view of duration; it is a mediocre analgesic and paralysing agent, *the action on the orthosympathetic nerve being fairly potent.*

(3) Stovaine, tropacocaine, and, above all, tutocaine, cause an impregnation of longer duration. Tutocaine, in particular, is an excellent analgesic agent. Its paralysing action is somewhat more pronounced, but its duration is too short. It affects the orthosympathetic nerve but moderately.

(4) Percaine, a quinoline derivative, has a very strong impregnating power, it is a real "mordant." *It has the same qualities as tutocaine* as regards its action on the sensitive and orthosympathetic fibres with the advantage of an appreciably *longer duration, but the factor which characterizes it and gives it an entirely special place in the series of anæsthetic agents is the intensity and duration of the blockage of the motor fibres.*" I wished to emphasize *the necessity of watching above all the respiratory movements when making a spinal anæsthesia with percaine*; this drug when used in very diluted solution (1:1,500) still produces a considerable muscular relaxation (an advantage for the surgeon but a possible danger for the respiratory function) while the orthosympathetic has already

regained a satisfactory function. As for tutocaine, and especially *novocain, it is principally the phenomenon of hypotension which attracts attention*; the muscular paralysis is of less intensity and duration which can be very annoying for the surgeon, but diminishes the danger of respiratory accident.

I agree with Dr. Falkner Hill's opinion that the danger of hypotension after novocain, tutocaine, etc., is not very great and that it can be further diminished by the preventive injection of ephedrine. He has possibly read in my paper in the *Bulletin de l'Académie* that *years ago* I used ephetonine (Merck), as soon as it became available, for all anæsthesias with tutocaine. When injecting all at once the entire dose of the anæsthetic agent, it is a wise measure; however, when injecting percaine fractionally, the preventive administration of ephedrine is in most cases useless and sometimes detrimental.

(5) *In my opinion one should not apply to all human beings the conclusions which my honourable colleague draws from his experiments on the cat, namely that it is impossible to reduce the blood-pressure below* 60 *mm. Hg. when the anæsthetic agent does not impregnate the phrenic roots.* Generally speaking, one can say that the cat is a pre-eminently orthosympatheticotonic animal, while the dog is pre-eminently parasympatheticotonic.

I believe that the cat can be compared to a rachi-resistant subject and the dog to one who is rachi-sensitive. In the rachi-resistant human being percaine influences the blood-pressure very tardily and the respiratory paralysis appears earlier than the bradycardia. But all men are not rachi-resistant and do not behave like the cat. In extremely rachi-sensitive individuals the fall of blood-pressure can manifest itself very early which has given rise to the theory of primary bulbar accident.

Without going further into the domain of experiments, I can say that years ago I saw in men after injection of novocain under the seventh dorsal vertebra, a rapid fall of blood-pressure down to zero while diaphragmatic respiration subsisted.

(6) *I stated that the theory of the primary bulbar acci-*

dent must be abandoned. On the contrary, Dr. Falkner Hill thinks that such accidents are possible, and he bases his opinion on the remarkable experiments on cats which he has published with MacDonald. He is possibly right, and further experiments in that direction would be instructive.

What I have endeavoured to convey is that in *clinical practice, with the proved techniques which are at present in use, and especially with the method of fractional injection with percaine, the anæsthetist need no longer fear the sudden and dramatic accident which occurred formerly with the older techniques* implying the use of thick needles, the removal of a substantial volume of cerebro-spinal fluid, brisk injection of concentrated solutions, barbotage, etc. *At present the bulbar accident is preceded by less important and less severe troubles which the attentive anæsthetist cannot fail to notice and which he can easily combat.*

(7) *I think Dr. Falkner Hill's judgment is perhaps a little too absolute when he deprecates the use of light and dilute anæsthetic solutions.* Our method of fractional injection of percaine has been employed in about 8,000 cases by myself, and especially by my assistants. It permits obtaining with all patients and for any abdominal operation an excellent and prolonged muscular relaxation. It can be used by any anæsthetist for high anæsthesia with success and without any danger worth mentioning, and, last but not least, it hardly ever causes cephalalgia.

I deprecate positively the use of a concentrated and heavy percaine solution, as suggested by Dr. Falkner Hill. When I first tried percaine I used a heavy but not viscous solution of this substance and observed that it caused *frequent and severe headaches.* In conclusion, I advise all those who have abandoned spinal anæsthesia because of failures, or of anxiety they have experienced, and all those who have not yet employed that incomparable method of anæsthesia, to try our method which will certainly give them satisfaction, and I shall welcome at any time such colleagues as would like to see it performed in my clinic.

BRUGES, 1935.

THE HICKMAN MEDAL

THE Council of the Royal Society of Medicine, on May 21st, unanimously decided to make the first award of the Hickman Medal to Dr. Wesley Bourne, of Montreal, upon the recommendation of the Council of the Anæsthetic Section.

Dr. Wesley Bourne holds the degrees of M.Sc., M.D., C.M. and F.R.C.P. (C). He occupies the unique position of being not only anæsthetist to the Royal Victoria Hospital, Montreal, but a lecturer in Pharmacology at McGill University. It is of interest that he took his degree of Master of Science in Anæsthetics—the only man, we believe, who has even attempted this feat.

He must be well known to many anæsthetists in this country, not only on account of the two visits he has paid us, one in 1926 and the other in 1932, but because of his considerable scientific writings resulting from many researches into the physioloyy and pharmacology of anæsthesia.

This history of the Hickman Medal is as follows:—

On November 17th, 1931, the Royal Society of Medicine accepted from the Henry Hill Hickman Memorial Committee a sum of £200 for the purpose of establishing a bronze medal to commemorate the work of Henry Hill Hickman in anæsthesia.

The medal, designed by Mr. T. H. Paget, is awarded by the Council of the Royal Society of Medicine on the recommendation of the Council of the Section of Anæsthetics. The award is made for orginal work of outstanding merit in anæsthesia or in subjects directly connected therewith.

Awards are to be made at intervals of not less than three years. The award is open to any person of any nationality and need not necessarily be made to medical men or women.

EXAMINING BOARD IN ENGLAND

By the Royal College of Physicians of London and the Royal College of Surgeons of England

REGULATIONS FOR OBTAINING THE DIPLOMA IN ANÆSTHETICS

(D.A., R.C.P. AND S. Eng.)

1. The Examination will be held in the months of May and November in each year.

2. The Examinations shall comprise:—

(*a*) Human Anatomy and Physiology, considered in relation to Anæsthesia.

(*b*) The History, Theory, and Practice of Anæsthesia, including—Inhalation Anæsthesia; Intravenous, Rectol, and other methods of inducing Anæsthesia; Local, Regional, and Spinal Anæsthesia in all varieties; Anæsthesia in its relationship to disease.

(*c*) Pre-operative investigation, preparation and medication; the recognition of post-operative complications and their treatment in so far as they are related to Anæsthesia.

(*d*) The Pharmacology and Elementary Chemistry of drugs used for, or in association with, Anæsthesia.

3. The Examination will be written and oral.

NOTE.—In the oral part of the Examination candidates will be required to demonstrate their knowledge of the use of the various types of apparatus employed in Anæsthesia.

4. Candidates are required to produce the following certificates before they are admissible to the Examination, viz.:—

(*a*) Of being in possession of a qualification in Medicine, Surgery and Midwifery which is registrable in the British Medical Register;

or, of being Graduates in Medicine and Surgery (M.D., or M.B. B.S.) of an Indian, Colonial, or Foreign University recognised by the Examining Board in England, but whose degrees are not registrable in this country.

(*b*) Of having, subsequent to the attainment of such qualification:—

Held resident appointments in recognised general hospitals for not less than twelve months, of which at least six months shall have been as Resident Anæsthetist;

or, personally administered anæsthetics in a general hospital or general hospitals recognised for the purpose on not less than one thousand recorded occasions, at least one half of which shall have been for major surgical procedures. (Candidates are required to submit with this certificate a detailed list of these major surgical procedures, indicating the type of Anæsthesia employed in each case. The certificate and the detailed list must be signed by the Senior Anæsthetist in the case of a general hospital associated with a recognised medical school, or by the Senior Surgeon of any other recognised general hospital.)

5. The above conditions of study may be modified at the discretion of the Committee of Management in the case of candidates (*a*) who have carried out original investigations in any branch of the science or practice of Anæsthesia; or (*b*) whose studies and practice have extended over a long

period without fulfilling the exact conditions; but exemption will not be granted from any part of the Examination.*

**Until May 1st, 1938, it shall be open to the Royal Colleges, on the recommendation of the Committee of Management of the Examining Board, to grant the Diploma, without examination to an Anæsthetist to a general hospital associated with a recognised medical school in the British Empire who has held this appointment for not less than ten years. The fee for such Diploma is six guineas.*

Enquiries to be addressed to the Secretary of the Board.

6. Candidates must give 21 days' notice in writing to the Secretary at the Examination Hall, 8–11 Queen Square, London, W.C. 1, of their intention to present themselves for examination, forwarding at the same time the necessary certificates. (Copies of the schedule of the required certificates must be obtained from the Secretary at the above address.)

7. The fee for admission or re-admission to the examination is £6 6s. (Fees should not be forwarded with the application, but when the card of admission to examination is received.)

8. Any representation which Candidates may desire to make with regard to the conduct of their examination must be addressed to the Secretary and not, under any circumstances, to any of the Examiners.

9. The Committee of Management may refuse to admit to examination, or to proceed with the examination of, any Candidate who infringes a regulation of the Examining Board in England, or is considered by the Committee to be guilty of behaviour prejudicial to the proper management and conduct of the examination.

Recognised Hospitals.

A. The general hospitals associated with any medical school recognised by the Examining Board in England.

B. The general hospitals which are recognised by the Council of the Royal College of Surgeons of England in connection with the regulations for admission to the Final Examination for the F.R.C.S. England.

C. The following hospitals. (Note.—This list will be compiled by the Committee of Management after consideration of each individual application for recognition.)

HORACE H. REW, *Secretary*,
The Examining Board in England.

The first Examination will begin on Friday, November 8th, 1935.

Forms of application for admission to the Examination may be obtained from the Secretary, Examination Hall, 8–11 Queen Square, London, W.C. 1, and must be completed and returned to him at least 21 days before the Examination.

REVIEW

Giornale Italiano di Anestesia e di Analgesia.

This journal, the first quarterly number of which appeared in April 1935, is to be the official organ of the recently formed *Societá Italiana di Anestesia e di Analgesia.* In their prefatory notice, the editors state that the journal, reporting the meetings of the Society and of its regional sections, and giving summaries of the proceedings of the French and American Societies, is certain to keep its readers closely in touch with the problems which are actually being tackled in the anæsthetic world and that it will do so "with so much the greater liveliness in that these problems will be vitalised by discussion with all the most eminent specialists in Europe and America." Particular care is to be given "to the selection and compilation of information drawn from the world's anæsthetic journals and from the journals of general and special surgery, where there are frequently scattered articles referrin gto the problems of anæsthesia."

There follows an account of the inaugural meeting of the Italian Society together with notices of the Thirteenth Congress at Boston, in October 1934, and of various sectional meetings in Italy. A message of goodwill comes from Dr. F. H. McMechan, of the International Anæsthesia Society. Dr. Robert Monod, of Paris, write on "L'Orientation et les moyens d'action d'une Société d'Etudes sur l'Anesthésie et l'Analgésie," and Dr. John S. Lundy, of the Mayo Clinic, writes on "The Duties of an Anæsthetic Service." There then follow articles of more direct clinical value: The value of loco-regional anæsthesia in the results from operations on the stomach and for thoracoplasty, by Prof. R. Alessandri, of Rome; Nerve block in the treatment of addiction to soporifics, by Greene, Pierson and Lichtenstein, of New York; Actual state of the surgery of pain, by Prof. Gino Pieri, of Udine; On the toxicity of certain local anæsthetics, by Piero Frugoni, of Milan; The actual state of anæsthesia in Germany, by Torquato Calzolari, of Siena.

Then follows a very comprehensive series of abstracts from American, British, French and German journals and an excellent bibliography. Here the editors have certainly fulfilled their promise. We look forward to the subsequent issues of the *Giornale Italiano*.

ABSTRACTS

Schmerz Narkose-Anæsthesia, February and April 1935.

An article differentiating the actions of avertin, pernocton and rectidon, which opens the February number, is of more theoretical than practical value. Darmstaedter contributes a long and highly technical paper on the chemistry of modern anæsthetics, which is largely taken up by the barbiturates. Oettel discusses the narcotic and intestinal effects of morphia; he supports the opinion held in some other quarters, but usually denied by clinicians, that opium improves intestinal tone.

The opening article of the April number is a thoroughly conservative one by Kulenkampff. He lays down the principles of general anæsthesia and recommends that they be carried out by the use of ethyl chloride for induction, followed by ether with occasional drop-doses of chloroform when necessary. The author has no good word for many of the most modern drugs or methods, most of which he regards as unjustifiably dangerous.

Dietz gives his erperience of 150 cases of perîdural anæsthesia after the method of Dogliotti. He is in favour of the process but does not regard it as perfected yet.

Barbiturates in primiparous labour. Amer. Journ. Obstet. and Gynecol., May 1935, p. 700.

The authors have tried a number of combinations of different barbiturates with ether, omnopon and scopolamine. None of their results lead them to enthusiastic recommendation of any one combination. They do, however, state that the barbiturates alone are of less value than in combination. The labour was shortest when analgesia and amnesia were most pronounced. In 25 per cent of the cases they found barbiturates acted as excitants, and apnœa in the infant was more common when barbiturates were used, and was aggravated by omnopon.

Nembutal in sea-sickness. F. L. McLaughlin. *Canadian Med. Assoc. Journ.*, May 1935, p. 545.

The author found 88 per cent of sufferers improved by the use of nembutal. He gave 1½ gr. on embarking and ½ gr. three times daily before meals. It is best if the treatment can start 24 hours before sailing. In those people who find headache the chief symptom of sea-sickness relief was much less than in those for whom nausea and vomiting were the main trouble. The study concerned 70 passengers.

Eleven years' work on anæsthetics. Brit. Med Journ., May 11, 1935, p. 984.

The work referred to is that of the Anæsthetics Committee set up jointly by the Medical Research Council and the Royal Society of Medicine. The Secretary, Dr. C. F. Hadfield, gave a retrospect of its activities to the Section of Anæsthetics. Among other things achieved, one of great practical importance has been the securing of a suitable denatured, duty-free ethyl alcohol for the manufacture of anæsthetic ether. The result is that anæsthetists can now obtain from all the chief manufacturers an ethyl alcohol no more expensive than the ether from methylated spirit which formerly was so much the cheaper that its use was almost forced on many who would have preferred the ethylic product.. The investigation of the purity of nitrous oxide and the inclusion of this as well as of other hitherto omitted agents in the British Pharmacopeia were further objects secured by the Committee. Explosions, ether convulsions and a number of new anæsthetic agents were also included in the investigations so lucidly summarised by Dr. Hadfield.

Prevention of heart syncope during operation. Anæsthesia and Analgesia, March–April 1935, p. 58.

The authors consider that sudden arrest of the heart in the course of an operation, particularly in chloroform or ether anæsthesia, is not from paralysis but from acutely developing motor irritation of the cardiac muscle, i.e. from ventricular fibrillation. Its prevention calls for not stimulating but rather for paralysing drugs. Quinine or quinidin in doses of 0.1 gm. twice daily diminish the predisposition to fibrillation and the authors recommend it in all patients

before operation. They recognise two contra-indications, (1) idiosyncracy to the drug, (2) uterine bleeding in obstetric and gynæcologic procedures. The simultaneous use of cardiac stimulants is not opposed by the use of quinine. The series of patients treated, which was without a fatality, comprised instances of hypertension, valvular disease, decompensation and arrhythmia, but was too small for statistical deduction.

Signs and phases of cyclopropane anæsthesia. Anæsthesia and Analgesia, March–April, 1935, p. 65.

The physical signs or the phases of cyclopropane narcosis are, according to the author, different from those of the old anæsthetics that the usually accepted "stages" should not be sought for. He recommends that these planes should be differentiated by three clear and easily detected phenomena. The first stage of induction is shown by the lid reflex till its disappearance, the second of moderate anæsthesia by the movement of the eyeball till this ceases, and the third of deep anæsthesia by the diminishing force and extent of the respiration. The effect of preliminary narcotics is to contract or flatten out each field so that the phases blend into each other more quickly. A diagram is supplied to illustrate the author's thesis.

Anesthésie et Analgésie, February 1935.

This is the first number of a new French journal of anæsthetics, the official organ of the Sociéte Francaise d' Anesthésie et l'Analgésie. It gives in detail the articles of the association, its aims and its proposed sessions. Prof. É. Desmarest contributes an article on the present position of the question of anæsthetics and shows his preference for nitrous oxide combined with basal anæsthetics. The Secretary of the Society, Dr. M. Monod, describes its object and its methods. It hopes to enlist the support of all who are interested in anæsthetics, not merely those who are actively engaged in their administration. Charrier and Houssi contribute a paper on spinal anæsthesia with percaine, especially as applied to upper abdominal surgery, and Jolltrain and Morat one on the biological modifications brought about in the organism by various methods of anæsthesia.